

```
In [50]: clf = neighbors.KNeighborsClassifier(n neighbors = 10, weights = 'distance', metric='euclidean')
        clf.fit(X train, y train)
         v pred = clf.predict(X test)
         print("KNN accuracy: ", accuracy score(y test, y pred))
         print("KNN f1 score: ", f1 score(y test, y pred, average='weighted'))
         print("KNN confusion matrix: ")
         print(confusion matrix(y test, y pred))
         KNN accuracy: 0.8518518518519
         KNN f1 score: 0.8546870914020672
         KNN confusion matrix:
         [[11 1 0]
          [0 7 0]
          [0 3 5]]
```

	df3['predicted_variety'] = y_pred											
	df3											
	C:\Users\Dell service\AppData\Local\Temp\ipykernel_3060\2710887449.py:1: SettingWithCopyWarning: A value is trying to be set on a copy of a slice from a DataFrame.											
	Try using .loc[row_indexer,col_indexer] = value instead											
	See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-virsus-a-copy											
			d_variety'	] = y_pred								
[52]:	sep	al.length	sepal.width	petal.length	petal.width	variety	predicted_variety					
	9	4.9	3.1		0.1	NaN	Setosa					
	11	4.8	3.0	1.6	0.2	NaN	Setosa					
	17	5.1	3.5	1.4	0.3	NaN	Setosa					
	27	5.2	3.5	1.5	0.2	NaN	Setosa					
	33	5.5	4.2		0.2	NaN	Setosa					
	50	7.0	3.2	4.7	1.4	NaN	Versicolor					
	68	6.2	2.2		1.5	NaN	Versicolor					
	70 71	5.9 6.1	3.2 2.8	4.8	1.8	NaN NaN	Virginica Versicolor					
	81	5.5	2.4	3.7	1.0	NaN	Versicolor					
	91	6.1	3.0		1.4	NaN	Versicolor					
	115	6.4	3.2	5.3	2.3	NaN	Virginica					
	118	7.7	2.6	6.9	2.3	NaN	Virginica					
	122	7.7	2.8	6.7	2.0	NaN	Virginica					
	144	6.7	3.0	5.7	2.5	NaN	Virginica					

## Logistic Regression

```
In [53]: from sklearn.linear model import LogisticRegression
         from sklearn.metrics import confusion matrix
         from sklearn.metrics import accuracy score
         from sklearn.metrics import f1 score
```

```
regressor = LogisticRegression()
regressor.fit(X train, v train)
# predict
predictions = regressor.predict(X test)
# evaluate
print("LR classification accuracy", accuracy score(y test, predictions))
# matrix confusion
cm = confusion matrix(y test, predictions)
print(cm)
# f1 score
print("LR f1 score", f1_score(y_test, predictions, average="macro"))
[[12 0 0]
[0 7 0]
[ 0 3 5]]
LR f1 score 0.8642533936651584
```

# Out[57]:

	sepal.length	sepal.width	petal.length	petal.width	variety	predicted_variety
9	4.9	3.1	1.5	0.1	NaN	Setosa
11	4.8	3.0	1.6	0.2	NaN	Setosa
17	5.1	3.5	1.4	0.3	NaN	Setosa
27	5.2	3.5	1.5	0.2	NaN	Setosa
33	5.5	4.2	1.4	0.2	NaN	Setosa
50	7.0	3.2	4.7	1.4	NaN	Versicolor
68	6.2	2.2	4.5	1.5	NaN	Versicolor
70	5.9	3.2	4.8	1.8	NaN	Virginica
71	6.1	2.8	4.0	1.3	NaN	Versicolor
81	5.5	2.4	3.7	1.0	NaN	Versicolor
91	6.1	3.0	4.6	1.4	NaN	Versicolor
115	6.4	3.2	5.3	2.3	NaN	Virginica
118	7.7	2.6	6.9	2.3	NaN	Virginica
22	7.7	2.8	6.7	2.0	NaN	Virginica
144	6.7	3.0	5.7	2.5	NaN	Virginica

### SVM

```
In [58]: # svm to classify
         from sklearn.svm import SVC
         from sklearn.metrics import confusion matrix
         from sklearn.metrics import accuracy score
         from sklearn.metrics import f1 score
         clf = SVC(kernel='linear')
         clf.fit(X train, v train)
         v pred = clf.predict(X test)
         print("SVM accuracy: ", accuracy score(y test, y pred))
         print("SVM f1 score: ", f1 score(y test, y pred, average='weighted'))
         print("SVM confusion matrix: ")
```

```
In [58]: # svm to classify
         from sklearn.svm import SVC
         from sklearn.metrics import confusion_matrix
         from sklearn.metrics import accuracy_score
         from sklearn.metrics import f1 score
         clf = SVC(kernel='linear')
         clf.fit(X_train, y_train)
         y pred = clf.predict(X test)
         print("SVM accuracy: ", accuracy_score(y_test, y_pred))
         print("SVM f1 score: ", f1_score(y_test, y_pred, average='weighted'))
         print("SVM confusion matrix: ")
         print(confusion matrix(y test, y pred))
         SVM accuracy: 0.8518518518518519
         SVM f1 score: 0.8436213991769547
         SVM confusion matrix:
         [[12 0 0]
          [0 7 0]
          [ 0 4 4]]
```

In [62]: df5['predicted\_variety'] = predictions
df5

#### Out[62]:

predicted_runety		pera	berminen.	a c panition	a channengan	
Setosa	NaN	0.1	1.5	3.1	4.9	9
Setosa	NaN	0.2	1.6	3.0	4.8	11
Setosa	NaN	0.3	1.4	3.5	5.1	17
Setosa	NaN	0.2	1.5	3.5	5.2	27
Setosa	NaN	0.2	1.4	4.2	5.5	33
Versicolor	NaN	1.4	4.7	3.2	7.0	50
Versicolor	NaN	1.5	4.5	2.2	6.2	68
Virginica	NaN	1.8	4.8	3.2	5.9	70
Versicolor	NaN	1.3	4.0	2.8	6.1	71
Versicolor	NaN	1.0	3.7	2.4	5.5	81
Versicolor	NaN	1.4	4.6	3.0	6.1	91
Virginica	NaN	2.3	5.3	3.2	6.4	115
Virginica	NaN	2.3	6.9	2.6	7.7	118
Virginica	NaN	2.0	6.7	2.8	7.7	122
Virginica	NaN	2.5	5.7	3.0	6.7	144

sepal.length sepal.width petal.length petal.width variety predicted\_variety

turning hyperparameter for svm

```
In [65]: # print best parameter after tuning
         print(grid.best_params_)
         # print how our model looks after hyper-parameter tuning
         print(grid.best estimator )
         # print accuracy score
         print("SVM accuracy: ", accuracy_score(y_test, grid.predict(X_test)))
         print("SVM f1 score: ", f1_score(y_test, grid.predict(X_test), average='weighted'))
         print("SVM confusion matrix: ")
         print(confusion matrix(y test, grid.predict(X test)))
         {'C': 1, 'gamma': 1, 'kernel': 'rbf'}
         SVC(C=1, gamma=1)
         SVM accuracy: 0.9629629629629
         SVM f1 score: 0.9629629629629629
         SVM confusion matrix:
         [[12 0 0]
          [0 7 0]
          [0 1 7]]
```

## Out[67]:

sepal.length         sepal.width         petal.length         petal.width         variety         predicted_variety           9         4.9         3.1         1.5         0.1         NaN         Setosa           11         4.8         3.0         1.6         0.2         NaN         Setosa           17         5.1         3.5         1.4         0.3         NaN         Setosa           27         5.2         3.5         1.5         0.2         NaN         Setosa           33         5.5         4.2         1.4         0.2         NaN         Setosa           50         7.0         3.2         4.7         1.4         NaN         Versicolor           68         6.2         2.2         4.5         1.5         NaN         Versicolor           70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Vir							
11         4.8         3.0         1.6         0.2         NaN         Setosa           17         5.1         3.5         1.4         0.3         NaN         Setosa           27         5.2         3.5         1.5         0.2         NaN         Setosa           33         5.5         4.2         1.4         0.2         NaN         Setosa           50         7.0         3.2         4.7         1.4         NaN         Versicolor           68         6.2         2.2         4.5         1.5         NaN         Versicolor           70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Virginica           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica <th></th> <th>sepal.length</th> <th>sepal.width</th> <th>petal.length</th> <th>petal.width</th> <th>variety</th> <th>predicted_variety</th>		sepal.length	sepal.width	petal.length	petal.width	variety	predicted_variety
17         5.1         3.5         1.4         0.3         NaN         Setosa           27         5.2         3.5         1.5         0.2         NaN         Setosa           33         5.5         4.2         1.4         0.2         NaN         Setosa           50         7.0         3.2         4.7         1.4         NaN         Versicolor           68         6.2         2.2         4.5         1.5         NaN         Versicolor           70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Virginica           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	9	4.9	3.1	1.5	0.1	NaN	Setosa
27         5.2         3.5         1.5         0.2         NaN         Setosa           33         5.5         4.2         1.4         0.2         NaN         Setosa           50         7.0         3.2         4.7         1.4         NaN         Versicolor           68         6.2         2.2         4.5         1.5         NaN         Versicolor           70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	11	4.8	3.0	1.6	0.2	NaN	Setosa
33         5.5         4.2         1.4         0.2         NaN         Setosa           50         7.0         3.2         4.7         1.4         NaN         Versicolor           68         6.2         2.2         4.5         1.5         NaN         Versicolor           70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	17	5.1	3.5	1.4	0.3	NaN	Setosa
50         7.0         3.2         4.7         1.4         NaN         Versicolor           68         6.2         2.2         4.5         1.5         NaN         Versicolor           70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	27	5.2	3.5	1.5	0.2	NaN	Setosa
68         6.2         2.2         4.5         1.5         NaN         Versicolor           70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	33	5.5	4.2	1.4	0.2	NaN	Setosa
70         5.9         3.2         4.8         1.8         NaN         Virginica           71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	50	7.0	3.2	4.7	1.4	NaN	Versicolor
71         6.1         2.8         4.0         1.3         NaN         Versicolor           81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	68	6.2	2.2	4.5	1.5	NaN	Versicolor
81         5.5         2.4         3.7         1.0         NaN         Versicolor           91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	70	5.9	3.2	4.8	1.8	NaN	Virginica
91         6.1         3.0         4.6         1.4         NaN         Versicolor           115         6.4         3.2         5.3         2.3         NaN         Virginica           118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	71	6.1	2.8	4.0	1.3	NaN	Versicolor
115     6.4     3.2     5.3     2.3     NaN     Virginica       118     7.7     2.6     6.9     2.3     NaN     Virginica       122     7.7     2.8     6.7     2.0     NaN     Virginica	81	5.5	2.4	3.7	1.0	NaN	Versicolor
118         7.7         2.6         6.9         2.3         NaN         Virginica           122         7.7         2.8         6.7         2.0         NaN         Virginica	91	6.1	3.0	4.6	1.4	NaN	Versicolor
<b>122</b> 7.7 2.8 6.7 2.0 NaN Virginica	115	6.4	3.2	5.3	2.3	NaN	Virginica
	118	7.7	2.6	6.9	2.3	NaN	Virginica
<b>144</b> 6.7 3.0 5.7 2.5 NaN Virginica	122	7.7	2.8	6.7	2.0	NaN	Virginica
	144	6.7	3.0	5.7	2.5	NaN	Virginica

#### Random forests

```
In [69]: from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.metrics import f1 score
```

```
In [70]: clf = RandomForestClassifier(n estimators=100, random state=0)
         # train model
         clf.fit(X train, y train)
         # predict
         v pred = clf.predict(X test)
         # evaluate
         print("RF accuracy: ", accuracy score(v test, v pred))
         print("RF f1 score: ", f1 score(y test, y pred, average='weighted'))
         print("RF confusion matrix: ")
         print(confusion_matrix(y_test, y_pred))
         RF accuracy: 1.0
         RF f1 score: 1.0
         RF confusion matrix:
         [[12 0 0]
          [0 7 0]
          [0 0 811
```

#### Out[74]:

		sepal.length	sepal.width	petal.length	petal.width	variety	predicted_variety
	9	4.9	3.1	1.5	0.1	NaN	Setosa
	11	4.8	3.0	1.6	0.2	NaN	Setosa
	17	5.1	3.5	1.4	0.3	NaN	Setosa
	27	5.2	3.5	1.5	0.2	NaN	Setosa
	33	5.5	4.2	1.4	0.2	NaN	Setosa
	50	7.0	3.2	4.7	1.4	NaN	Versicolor
	68	6.2	2.2	4.5	1.5	NaN	Versicolor
	70	5.9	3.2	4.8	1.8	NaN	Virginica
	71	6.1	2.8	4.0	1.3	NaN	Versicolor
	81	5.5	2.4	3.7	1.0	NaN	Versicolor
	91	6.1	3.0	4.6	1.4	NaN	Versicolor
1	115	6.4	3.2	5.3	2.3	NaN	Virginica
1	118	7.7	2.6	6.9	2.3	NaN	Virginica
1	122	7.7	2.8	6.7	2.0	NaN	Virginica
1	144	6.7	3.0	5.7	2.5	NaN	Virginica